



Lean thinking for the NHS

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Registered Charity no. 1090329
Published by the NHS Confederation

© NHS Confederation 2006
ISBN 1 85947 127 7

BOK 56701

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Foreword

We asked the Lean Enterprise Academy to look at how Toyota's approach to production could be applied to healthcare. This is not as odd as it first appears. The Toyota system – often known as Lean – has been applied in many environments, including healthcare (and not just manufacturing) for some time now, with staggering improvements in quality and efficiency. The underpinning values of removing activities that don't add value and of respect for people and society lie at the heart of healthcare. And the principles on which Lean is based are generic. They can be applied anywhere: at home, in a bank, GP practice or hospital.

A number of things have struck me about places I have visited where people are implementing Lean. Firstly, the clinicians are involved and enthusiastic. People seem to be having fun. Secondly, the scale of the improvements is often extraordinary. More problematically, the transformations require whole processes to be looked at, with teams sometimes taking an entire week out – often more than once. It is also striking how far Lean principles run counter to received common sense – they challenge the whole idea of economies of scale, of batching and queueing work, triage and de-skilling. Many of these ideas about the organisation of work are deeply held and often wrong. Most counter-intuitive of all is the idea that we can get more done by working the system less hard.

The results are potentially very significant. Lean's focus on delivering care is a refreshing antidote to benchmarks, targets and the traditional approach to performance management. The emphasis it puts on looking at the whole system is valuable.

For me, one of the most important insights is that many traditional approaches to efficiency improvement are futile and focus on the wrong thing.

- In most organisations of whatever type, there is at least nine times more non-value-adding activity than there is work that actually meets the patients' needs. So even if the value-adding component is improved by 50 per cent this will have a very small impact on overall productivity.
- Improving value-adding components in isolation without addressing the whole process may not improve efficiency at all. A faster machine in pathology or a quicker transfer from accident and emergency to a ward may simply mean that the specimen or the patient waits somewhere different and longer for the next stage in the process.
- Lean focuses the improvement effort on things that matter to patients and clinicians, and on the things that cause them stress and get in the way of care – as opposed to external benchmarks or national targets, which tend to be expressed in terms that are only indirectly related to improving patient care.

There is one other key insight I have gained from talking to people developing Lean approaches. Lean has to be locally led and be part of the organisation's strategy. It cannot be imposed from outside: a sure way to kill it would be for there to be a national or regional programme.

The Lean Enterprise Academy has set up a Lean Healthcare Network to help people exchange ideas and experience. The NHS Confederation's Future Healthcare Network is also investigating the very significant implications for the design and size of buildings. Details can be found at the end of this report.

Nigel Edwards, Policy Director
NHS Confederation

The need for change

Although the NHS has made significant progress over the last few years, there is a nagging doubt that the improvements should have been more significant. Also, there are many significant challenges that still need to be addressed, including:

- financial deficits
- hospital-acquired infections and avoidable injury and death
- capacity constraints
- accusations of endemic inefficiency
- public and political concern about waiting lists and costs.

But problems like these are common to many industries. Poor safety and quality, capacity constraints and queues, cash-flow crises, low levels of efficiency and low levels of staff motivation are not confined to the NHS. They plague organisations across the world, particularly in healthcare.

So here is the good news. It is possible to improve quality (to deliver better and more timely patient care), to make working lives less stressful and more rewarding for staff and to boost efficiency and productivity (thereby pleasing politicians and taxpayers), all at the same time.

And it's possible to do all these things without painful restructurings, cash injections or massive new investments in infrastructure or IT – by applying the principles of Lean to the health service.

This report introduces the concept of Lean. It shows how Lean is already being applied in the health sector, and why it is essential to a strong, successful NHS. Its message is simple.

Lean can help save healthcare

Sceptical? So you should be. But please remember three things as you read on.

- 1** An enormous amount of work has already been done in the NHS which has prepared the ground for Lean: work done to clear bottlenecks at every point in the patient's journey; to understand the scale and the causes of variability of demand and to smooth it where possible. Lean builds on this large body of excellent work, adding some more tools and providing more of a framework.
- 2** Remember that Lean is not a management fad. It is a tried and tested methodology for improving the way work gets done. Lean has been spreading slowly and inexorably from industry to industry for over half a century as its principles have been fine-tuned, tested, demonstrated and proved – largely against the better judgement of people who looked at it and declared "it will never work here!"
- 3** If your hospital is struggling with end-of-year financial deficits, ward closures and redundancies, Lean is not going to be your saviour in the short term. Lean will make immediate improvements and help you avoid deficits in the medium to long term, but it cannot help you resolve immediate financial crises. Indeed, because Lean principles take time to embed, and because their application relies on the positive commitment and support of staff in their day-to-day work, the best way to squander the opportunity presented by Lean is to link it to short-term slash-and-burn cost-cutting.

In other words, Lean is about building a positive future – managing healthcare organisations in a completely different way so that short-term fire-fighting becomes a thing of the past.

So, bearing these points in mind, what is so special about Lean?

A good start

Like many NHS services, the pathology department at the Bolton Hospital has grown like topsy. It currently employs over 100 staff across many specialisms. Their daily work conducting thousands of tests each day, using a wide range of specialist equipment, is vital to the effective functioning of the hospital and the NHS trust as a whole. But both its users and its staff experience daily frustrations. Tests take longer than they should, causing delays. Staff feel they are under constant pressure.

Mapping the work

Recently, however, a team of staff at the hospital took a step back to see how their department really worked. They followed blood samples on their journey from the patient, through the haematology, biochemistry and microbiology laboratories and back again, and painstakingly tracked every step the sample took – received with a request form, checked to make sure the sample is from the right patient, assigned a unique laboratory number for processing through the IT system, information input into the computer, and so on.

When they looked at the department's processes like this, end to end, a number of blockages and unnecessary steps became immediately obvious. For example, they could not analyse a sample before the information had been put into the computer but inputting delays are common, caused by samples arriving in large batches. And once they had the information, taking the sample to the analyser could be quite a trek.

Over the years, as the department grew, new space was found in two buildings separated by the main hospital corridor, upstairs and downstairs, in a number of separate rooms. And as new machines were purchased, they were placed wherever room could be found: some on the ground floor on one side of the corridor, others on the first floor on the other side. Staff stored work before making the

journey from one location to another (otherwise every day would be a marathon). Samples were analysed on a batch and queue basis, with one day's samples gathered together for analysing the next day. This meant a minimum 24-hour turnaround standard for some tests.

Having seen how the system actually worked, the staff saw many ways to improve it. Why not:

- knock rooms together so that staff can go directly from A to B instead of having to travel via the corridor?
- place analysers together so that staff don't have to trek up and down stairs to access them?
- move the central sample receiving point to the middle of the department, to minimise the sample's journey from receipt to analysis?
- create a standard sample request form for blood sciences that can be scanned into the computer, thereby eliminating a large amount of time-wasting, non-value-adding clerical work?
- analyse each rack as soon as it is filled rather than accumulate a whole batch of samples?

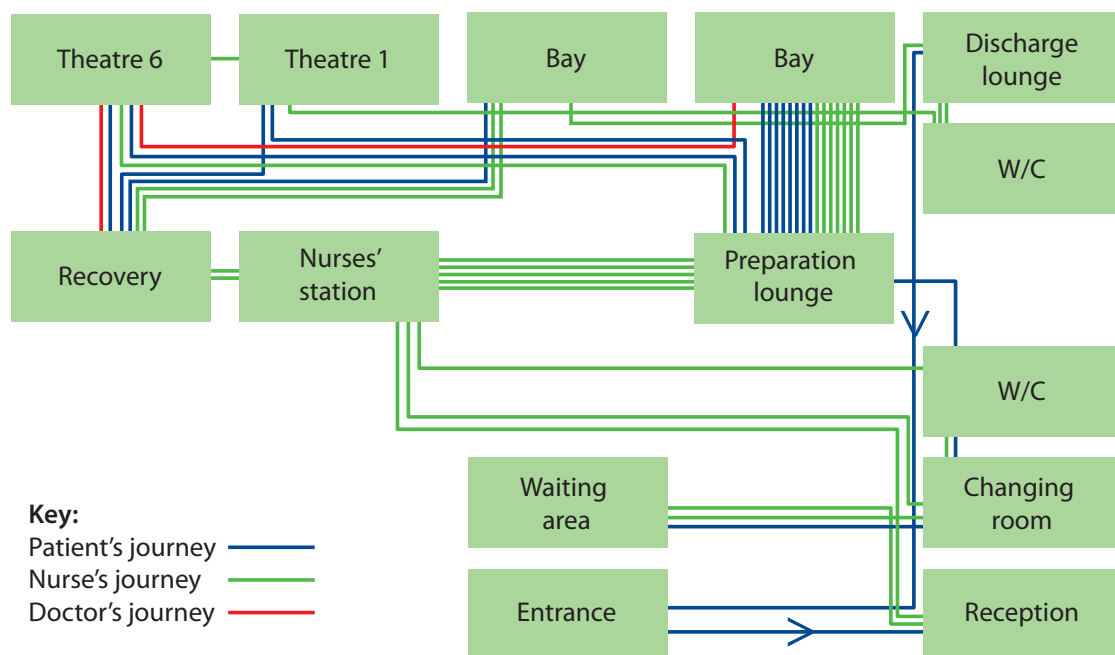
Such detailed suggestion may not sound like much. But put together in the right way, the results were dramatic. A routine blood sample's journey once involved 309 steps, but with a redesign of work, machine relocation and so on, this could be reduced to just 57 steps. Urgent blood sample steps could be reduced from 75 to 57, and so on. Simply relocating two analysers from the first floor to the ground floor and redesigning the workspace would reduce the distance staff have to walk each day by 80 per cent – saving huge amounts of both time and energy. All in all, the time taken to process samples for endocrinology and haematinics could be cut from between 24 and 30 hours to between two and three hours.

What's more, the same amount of work could be done with fewer staff (who are being redeployed to more productive activities), and the actual amount of space used by the department could be reduced by 50 per cent. This had further knock-on benefits for the blood transfusion department. Before, the department was located at the end of a long corridor which staff had to walk up and down in order to collect or deliver blood products. Now it could be moved closer to the wards, saving even more time and energy.

It is certain that Bolton's pathology department is typical of every healthcare system around the developed world and the improvements can be replicated across the entire NHS.

Figure 1 shows a 'spaghetti diagram' like the one drawn up at Bolton Hospital's pathology department. Spaghetti diagrams highlight wasted journeys and effort. This example is from a Wirral Hospital analysis of its day care unit.

Figure 1. Analysis of day care unit, Wirral Hospital



The benefits of Lean

Flinders Medical Centre, a medium-sized public sector teaching hospital in Adelaide, South Australia, has been implementing Lean principles for just over two and a half years.

Professor David Ben-Tovim, the director of the team responsible for redesigning care at the hospital, reports the following results: "We have found that we can do 15 to 20 per cent more work, offer a safer service, on the same budget, using the same infrastructure, staff and technology. Everything has improved: cost, quality, delivery, service – and staff morale."

Before introducing Lean, Flinders was close to meltdown. David Ben-Tovim said: "We found ourselves struggling with an absolutely critical problem delivering safe care. Our emergency department was so congested that it was an unsafe place to be. Patients were waiting an unacceptably long time to see a doctor, and we had a worrying increase in really serious adverse events."

"We hadn't been sitting on our hands. We had tried everything that was common practice for dealing with this kind of problem. But nothing had a big enough effect to really help us out."

Before, "we simply did not have any sense of being in control", says Professor Ben-Tovim. "Now the institution as a whole is much more optimistic. This year, it is coming in below its budgeted costs. So, for the first time in years, it is able to invest some of this surplus in much-needed equipment. At the same time, gross errors are being squeezed out of the system. For example, the number of notifications [where the hospital is sued for errors that cause death or disability] has fallen dramatically from 87 when we started to 32 last year. And many of these notifications are coming from areas of the hospital we haven't reached with Lean yet."

The Lean progression

What Lean is not

Lean is not mean

One of the key principles of the Toyota system on which Lean is based is respect for people and society. Lean is not about headcount reductions. It is about being able to do more – improve patient care – with existing resources. Lean often means the same things can be achieved using fewer people. This means people and resources can be redeployed to create even more value. The purpose of Lean is not to make staff redundant. It is to deliver better healthcare at lower overall cost.

Typically, implementation of Lean principles brings four waves of benefit:

- improved quality and safety – fewer mistakes, accidents and errors, resulting in better patient care
- improved delivery – better work gets done sooner
- improved throughput – the same people, using the same equipment, find they are capable of achieving much more
- accelerating momentum – a stable working environment with clear, standardised procedures creates the foundations for constant improvement.

There is another benefit that comes with each wave. Staff morale improves. "What makes Lean so powerful", says David Fillingham, chief executive of Bolton NHS Trust, "is that it engages the enthusiasm of front-line staff."

Flinders and Bolton are still at the beginning of their journeys. But both are now convinced Lean can save healthcare. But why? And how?

Why Lean works

Why does Lean work? The answer is simple. Lean tackles the heart of the matter: how the organisation's work gets done.

The Lean insight is that when it comes to work, there are countless different ways for organisations to fritter away time, energy and resources doing things that don't add value for the customer – in our case, the patient. It is very easy for layer upon layer of these waste-causing activities to accumulate, until a very high proportion of everything the organisation does is non-value adding rather than value-adding. Eventually this suffocates its potential.

Let's look at how things often go wrong.

Things are hard to see

When errors are investigated – for example drug errors resulting from similar products with similar labels being stored next to each other – it is generally discovered that similar mistakes have been made many times before, and that many, many times before staff have come close to making such a mistake – and avoided it only by a last-minute check. It has taken a national intervention to take the apparently simple step of ensuring that drugs were packaged, labelled and stored in such a way that mistakes became almost impossible to make in the first place. And until the development of the National Patient Safety Agency there wasn't a national system in place for people to raise issues like these.

Responsibilities are not clear

Too many older patients with fractured hips end up suffering from dehydration. Why? Because, very often, they also have a heart, lung or other medical condition which is only discovered when they are being prepared for surgery, causing the operation to be delayed. But because the patient has been fasting in preparation for the operation, they are more prone

to dehydration. The problem is exacerbated because patients are scattered around the hospital (fitted into whatever bed has become available), with orthopaedic consultants focusing on one problem, medical staff focusing on the other problems, and not enough communication between them.

Unnecessary work keeps on being created

Because a new machine has been placed where a place can be found for it, every time staff want to use it they have to make an extra journey. Because there is no clear system for bed allocations, staff have to keep on phoning, again and again, to see if they have got a slot for a patient. Because there isn't a standard approach to treating a particular ailment or condition, doctors order tests which, strictly speaking, aren't necessary. Because nurses don't have the right materials or information available at the right place at the right time, they spend a large portion of their day tracking things down rather than actually doing nursing.

Once work is looked at through Lean eyes, it becomes clear that people often do more unnecessary work than necessary work: they are having to work very hard just to get into a position where they can do their jobs.

Processes are not joined up

A test is not ready for when the consultant does his rounds so a decision is delayed and a patient remains in a bed that could be used for someone else. A patient is being readied for discharge but social services have not liaised with voluntary services, or an ambulance hasn't been ordered, so the discharge falls through. 'Disconnects' like these are common in hospitals which, like many organisations, are organised around departmental silos.

Figure 2. Process complexity and likelihood of error

Number of process steps	Probability of success, each process step		
	0.95	0.99	0.999
1	0.95	0.99	0.999
25	0.28	0.78	0.98
50	0.08	0.61	0.95

Disconnects are also compounded by cultures of expertise where specialists create islands of excellence at what they actually do, but everything else is invisible to them. In fact, in the NHS today, nobody ever sees the end-to-end patient journey from admission through to discharge (except for patients themselves); it is no-one's job to manage this journey as a whole. So disconnects are almost built in to how the system operates.

Inappropriate measures and targets

Many accounting measures such as unit cost and asset utilisation focus on just one isolated part of a complex process. Subsequent attempts to improve efficiency and productivity simply pass costs on to another department rather than improving the efficiency of the process as a whole. For example, a buyer buys bulk supplies to qualify for a volume discount, which reduces unit costs. But because the supplies are not needed immediately, cash is tied up in inventory and extra time and money has to be spent storing the excess stock, accessing it etc.

Problems are not resolved

When things go wrong, it creates extra pressure to 'get the job done', whereas, invariably, getting to the root of the problem takes extra time and effort and usually requires the co-operation of some other party. The nurse cannot tell drug companies or the

pharmacy to label products better. So the cause of the problem never gets addressed.

Things get compounded

A basic lack of visibility, confused responsibilities, unnecessary work, disconnects, extra work-arounds: they all add up and tangle with one another. And the more complex things become, the greater the chance of errors that undermines quality and/or threaten safety. For example, if there is a 5 per cent chance of making a mistake for each step in a series of tasks, and if there are 50 steps, the chance of getting them all right is less than 10 per cent (see Figure 2). Many NHS processes involve hundreds of steps, so what chance is there for an error-free outcome?

Frustration dissipates energy

Because the quality of the organisation's core processes is poor, mistakes are made and the organisation gets sucked into endless fire-fighting. A blaming culture can take root. More and more of the organisation's resources are dissipated working around, rather than resolving, its underlying problems. Staff want to do a good job, but the system doesn't let them.

The Lean opportunity

Lean brings two things to the party. First, it turns a big problem into a huge opportunity. From a Lean perspective about 95 per cent of everything most organisations do is not value adding. Some of these activities are very hard to eliminate. (Paying invoices doesn't directly improve patient care, for example, but it has to be done.) On the other hand, many of these non-value-adding activities are avoidable.

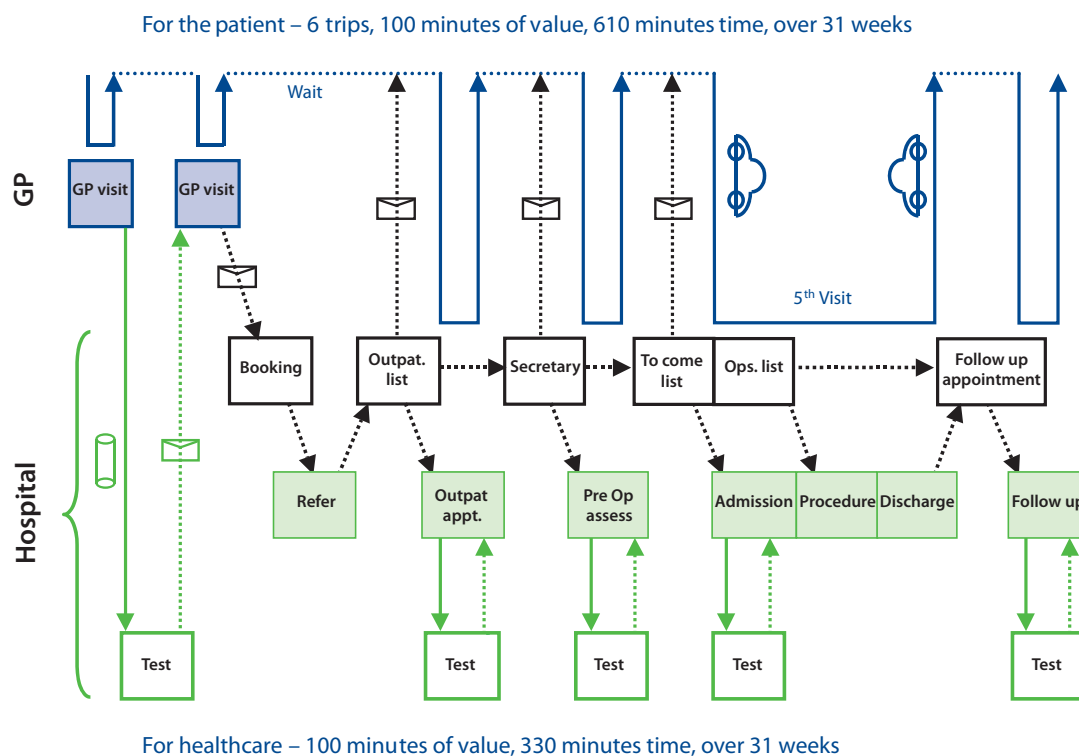
Take this example from the Wirral Hospital (see Figure 3) which shows the results of a value stream mapping exercise.

The chart depicts the steps taken by the GP, hospital, hospital administration, support services and the patient himself, in order to complete a treatment.

The time spent actually treating the patient was 100 minutes. The total time actually required to deliver this treatment was 610 minutes on the part of the patient, and 330 minutes on the part of the hospital. But the whole process took 31 weeks, most of which was spent waiting or doing work not directly related to the treatment. Wirral Hospital is not an exception. It is pretty typical. Just imagine if all this wasted time, effort and resource was released to add new value instead!

Figure 3. A high-level value stream mapping exercise charts the time taken by each main party in the treatment process at each step, and between each step. Like most organisations, there is no one in the NHS responsible for managing and improving such processes from end to end, start to finish.

Figure 3. Time taken in treatment process by each party



The second thing Lean contributes is a set of principles and tools to disentangle the various forms of waste and tackle their root causes. Used separately, these tools are helpful. Used together, in a planned, disciplined and co-ordinated way, they can chip away at accumulated layers of waste to release the organisation's real potential.

Here is a selection of these tools and approaches:

- focus on improving the end-to-end process
- where things are hard to see, make them as visible as possible so that everyone can see when and if there is a problem
- where responsibilities are not clear, create detailed, standardised processes to avoid error, ambiguity and confusion – and as a springboard for improvement
- where there is unnecessary work or waste, whether it is in the form of excess inventory, excess processing, excess movement of people or things, waiting and queuing, redesign the work
- where problems are not resolved, ferret out their root cause ('five whys').

We have not mentioned targets. Targets can be useful. They focus the mind. They can motivate people to work hard. But the point of setting a target is not to reach the target come what may (by squeezing other, non-targeted activities for example, or by working the system). The real point is to create a system capable of reaching the targets on an everyday 'as per usual' basis. That is what Lean is about: creating a continually improving system which is capable of achieving more, using less.

What Lean is not

Lean is not cost-cutting

Every organisation incurs two types of cost:

- costs that deliver value to customers or patients. These costs are good and are to be encouraged. They result in the value that people pay for either directly or through their taxes.
- costs that are incurred but don't end up delivering value to customers or patients. These costs are waste. Lean is about eliminating the waste and improving flow, to improve the proportion of good costs to bad.

Too many cost-cutting exercises fail to discriminate between the two forms of cost, which is why they often end up causing as much harm as good. One insight of Lean lies in this distinction between waste and value.

Lean is not the same as productivity improvements

Productivity usually means sweating existing assets – whether machines or people – harder. But working harder at doing the wrong things is pointless. Wasting effort more efficiently is still waste. So Lean is not simply about productivity. It is about aligning every bit of work that is done up, down, through and across the organisation so that the patient flows through the process from end to end with minimal interruptions and with a supply of skill, expertise, materials and information that exactly meets demand.

How Lean works

Lean works by restoring the organisation's work to its natural rhythm, so the work flows naturally.

Imagine a situation where there is a perfect match between supply and demand: say, traffic load of 1,000 vehicles an hour and a two-lane road capable of carrying exactly this number. How could we mess this perfect match up?

One thing we could do is let slow-moving lorries travel in both lanes so that they slow down faster-moving cars. That's a surefire way of creating queues and illustrates one of the core insights of Lean: if you mix two different value streams – that is, sequences of value-adding steps that follow a different logic and move at different paces – then they will interfere with each other to create the worst of both worlds.

An example from Flinders

Two years ago, the emergency department at Flinders Medical Centre in Adelaide, South Australia was bursting at the seams. Around 50,000 patients were attending Flinders' emergency department every year, some 40 per cent of whom were admitted to hospital, and the complicated triage system it was using just couldn't cope. Under this system each patient was placed into one of five urgency categories, and each category of patient was supposed to be seen within a certain time frame.

Managing this system required a great deal of work: each patient had to be assessed and allocated a category and a time slot. It also involved a lot of re-work. Every time a new patient came in, he or she had to be slotted into the queue at the right place: patients in the less urgent categories were continually pushed down the queue. In September 2003 more than 1,000 patients waited in the emergency department for more than eight hours before being treated. At times, there were up to 80 patients waiting in the department.

Then Flinders staff realised that the emergency department was not one, but at least two value streams:

- patients who can be treated and discharged more or less immediately
- patients who need to be admitted into a ward for further treatment.

So they decided to separate out, at triage, the two groups of patients, literally placing them in different physical locations and treating them in different – and more appropriate – ways. Provided there was no threat to life or limb, patients deemed 'likely to go home' were treated on a first in, first out basis (thereby simplifying the triage process considerably).

The effects were instant. Average emergency department waiting times fell 25 per cent (with 70 per cent of patients going home within four hours). Also, the numbers leaving the department without seeing a doctor fell by 41 per cent. Staff felt the pressure ease.

By improving the flow of work through the department they were able to make much better use of its capacity.

Many NHS hospitals will be familiar with the Flinders approach. See and Treat and the Modernisation Agency's Emergency Services Collaborative utilised Lean principles. So, all those hospitals that have been streaming patients through accident and emergency, identifying and eliminating bottlenecks and improving flow have been adopting Lean methods, even though they may not have fully realised it.

So that is one way Lean works: by enabling different value streams to flow according to their own logic and pace, without interference.

Connecting the parts better

Returning to the example of the motorway, another way to clog the traffic flow would be to construct it in different sections with poor connections between them. The NHS is full of such disconnects. We've seen some examples already. A test fails to arrive before a consultant does his round, so treatment gets delayed. Liaison with social services and transport services breaks down, so the patient isn't discharged as planned.

Any contact needed between members of staff to achieve a task is known as a hand-off and is a source of potential delay or error. When Bolton Hospital mapped the hand-offs needed to complete a complex discharge, it discovered more than 250 (see Figure 4). The more hand-offs there are, the greater the chance of something going wrong. Then traffic comes to a halt when it should be flowing.

Figure 4. Steps taken to discharge a patient

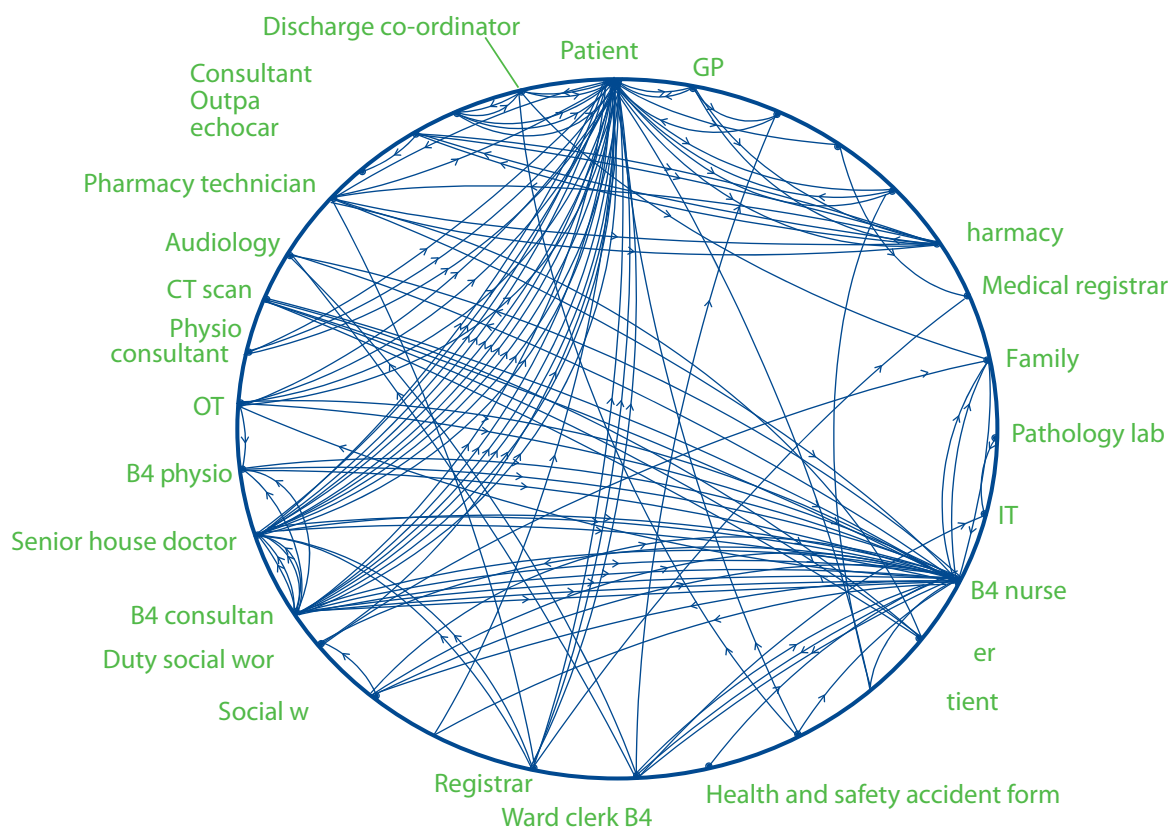


Figure 4. Steps taken to discharge a patient from Bolton hospital – results of a mapping exercise undertaken by hospital staff.

Earlier, we mentioned the problems often faced by older patients with fractures: concurrent medical problems complicate treatment, and patient care suffers as specialists fail to communicate and co-ordinate. To tackle this problem, Bolton borrowed a concept straight from Toyota – the work team or cell – by creating a special trauma unit with its own physical space that combines all the skills (geriatricians, orthopaedic surgeons, medics and other clinical specialists) needed to care for the patient in a single team.

It then created standardised processes for the hand-offs between each team member so that issues are identified and addressed as and when they need to be, regardless of who is on duty, on leave or tied up elsewhere. It is too early to be sure (statistically speaking), but early indications suggest that post-operative mortality rates for fractured hips have halved as a result of these changes.

Easing the flow

Yet another way to clog the motorway is by creating rush hours: shoehorn 3,000 vehicles onto the road in one hour, with hardly any traffic at other times. Artificially induced rush hours are endemic in the NHS: in day care when all patients are asked to arrive at 8am even if some of them won't be treated until noon; when samples are held back in pathology so that they can be processed in batches; when a surgeon conducts many similar operations one after the other thus flooding wards with a sudden rush of patients needing similar treatments, and so on.

People working within the NHS experience daily volatility and unpredictability. But most of this volatility is not created by patients but by the way the NHS itself works. Figure 5 below shows variations in accident and elective admissions for a large teaching hospital between February 2002

Figure 5. Variation in elective and emergency admissions

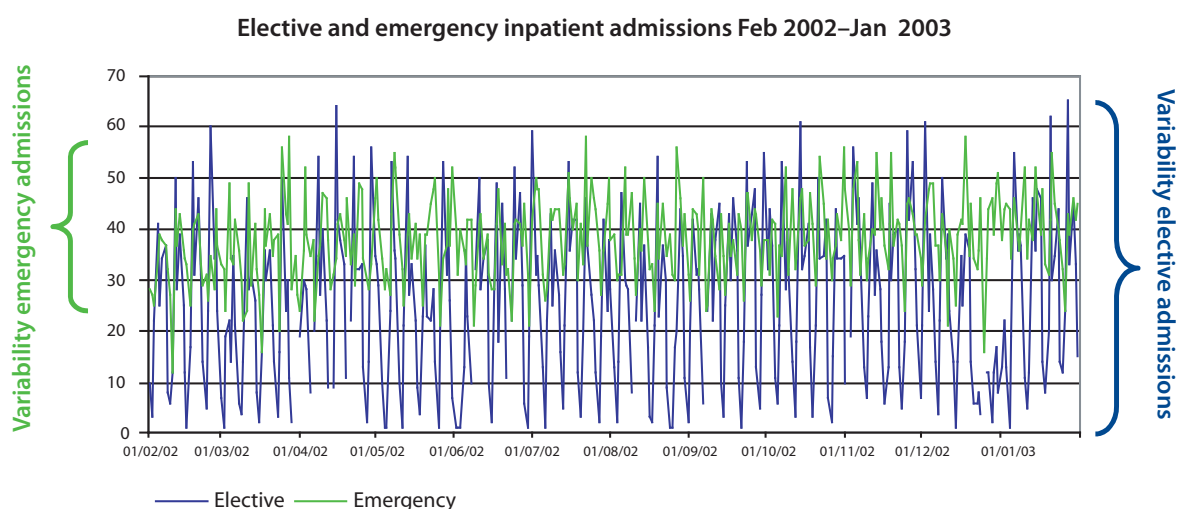


Figure 5: Large teaching hospital: variation in elective admissions is twice that of emergency admissions.

Source: Dr Richard Lendon, Kate Silvester and Richard Steyn, *Flow across healthcare systems*, June 2004.

and January 2003. Variation in elective admissions is twice as high as emergency admission – a by-product of the hospital's policies, not real patient demand.

So Lean works by smoothing demand where it can be smoothed, and by developing the flexibility to cope with variability when it is unavoidable. By moving from batch and queue towards flow – processing ever smaller volumes ever more frequently – the twin evils of batch (too much work in some parts of the system and too little in the others) can be avoided and capacity can be used much more efficiently.

Wirral Hospital is currently working on a scheme to increase flow through its surgeries. Instead of conducting many of the same operations on one day and many of another type of operation on the next day, it plans to move to a system where it does

a few of each type of operation each day. This will have the effect of reducing waiting times for patients while also reducing pressure on wards.

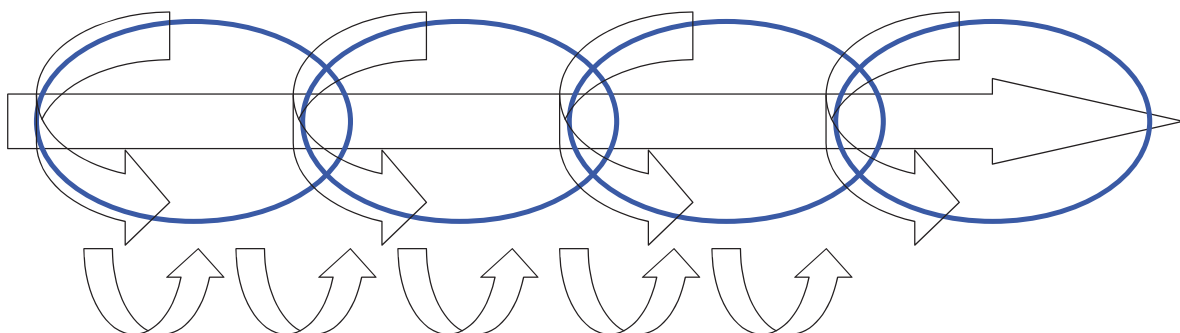
Working to real demand

Our original motorway was a resource that was perfectly aligned to demand. But with poor management of traffic flows (value streams), disconnects and rush hours (batch and queue), we still managed to clog it up. Lean solves such problems by pulling value through the system from end to end as and when it is needed, instead of pushing it.

If we know that underlying demand is for, say, 100 admissions a day, that means we need to discharge

Figure 6. The Lean ideal

Pull at work: every step pulls people and skills, materials and information towards it, one at a time, as and when needed



Support processes:

Pathology, Radiology, Pharmacy, CSSD, Laundry etc

Figure 6. The Lean ideal: patients are 'pulled' through the hospital system at a rate that keeps pace with demand. Discharge pulls patients from wards, wards pull patients from surgery

and admissions while pulling support processes from support departments, all with zero waiting time or wasted effort.

100 patients a day, the wards have to be in a position to take on 100 patients a day, admission ready to admit 100 patients, and so on. Lean practitioners call this 'takt' time: the amount of time you need to spend on each activity if you want to achieve output in line with demand. Takt time is a way of identifying how fast work, materials etc should be flowing through the system, from department to department, task to task. This means shifting our thinking from measuring activity to understanding demand – one is not a proxy for the other.

Achieving this sort of flow involves revisiting and redesigning every key process along the way (admissions, surgery, bed management, discharge) and all the interfaces between them. The ultimate aim is to create a pull system where each step of the process – from discharge backwards – pulls patients towards it as and when it is ready (see Figure 6).

Pressure in perspective

Three myths dog the NHS:

- demand for health services is effectively infinite
- demand for health services is volatile and unpredictable
- there is not (and might never be) enough capacity to keep up with the scale and/or variability of demand. So we have to ration services, and this rationing takes the form of queues.

Yes, we could always find new ways to spend more money on new and better drugs, treatments and machines. But in reality demand for most health services is relatively stable and finite (there are only so many cancer patients, heart patients, diabetics, accidents and emergencies, etc). And as we've seen, short-term demand is also surprisingly stable – it falls within predictable ranges.

It may – or may not – be true that the NHS needs more resources or lacks capacity. We cannot know for sure because of all the disconnects and blockages that currently undermine its performance. What we do know, however, is that with or without extra resource there is a huge amount of untapped potential just waiting to be unleashed.

Lean and process improvement

Lean thinking brings together several strands of process improvement. It starts by defining the purpose of the process (value for the customer), then redesigns the process to deliver this value with minimum wasted time, effort and cost. It then organises people and organisations to manage this value delivery process.

The contributions of quality improvement initiatives, such as Total Quality and Six Sigma, in measuring the root causes of variance (using, for instance, statistical process control charts) are essential if activities are to be linked into a continuous flow. Total Productive Maintenance (TPM) helps improving equipment availability. The Theory of Constraints (TOC) shows how to manage bottlenecks until we can remove them. Systems dynamics helps to understand how to optimise the whole process (rather than optimising individual activities) over time.

Core principles

We are now in a position to summarise the Lean approach to performance improvement.

Patient perspective

Under Lean, value is defined solely from the customer's perspective – in our case, this will generally be the patient. Anything that helps treat the patient is value-adding. Everything else is waste. Lean eliminates waste and reinvests released resources in value creation.

Pull

To create value we need to provide services in line with demand. No less. And no more. Delivering care in line with demand means not producing it to meet some other, artificially imposed metric such as a productivity, asset utilisation or unit cost target. (Performance is a by-product of how the system works and not an end in itself. If we eliminate waste, budgets and targets will be met along the way).

Delivering services in line with demand also means all work, materials and information should be pulled towards the task as and when needed. Not before. Not after. Any time spent waiting or queuing is another form of waste: resources are being used up but are idle.

Flow

Pull leads to flow where each patient is worked with, one unit at a time, and passed on for the next step of the process without any delay. A preoccupation of Lean is to identify blockages and obstacles that cause delay, and to remove them.

Value streams

For flow to happen we need to design and manage each value stream – each sequence of steps that adds value for the patient from the start of the journey to

the finish – as a single integrated whole. Each step in the process needs to be designed with an eye to the effects it has on the steps that precede it and follow it – so that they all link together seamlessly.

What Lean is not

Lean is not restructuring

Lean is about changing the work itself, not about who gives what orders or who reports to whom. All too often, organisational restructuring and reorganisation is merely a displacement activity. If the actual work people do does not change and improve, then restructuring is irrelevant. And if restructuring interferes in the way work should be done (as it often does) it is worse than useless. Sometimes, organisations need restructuring. But the general rule of thumb is that restructuring should happen after the basic work problems have been sorted out, not before.

Perfection

By creating clear, easily seen, standardised processes we can create a foundation for continuous improvement, where each new improvement in the process becomes a platform for the next one.

Ward pull in practice

Moving to flow and enabling pull is often counter-intuitive to traditionally trained managers, who tend to think in terms of push – for example when a patient is ready for admission in accident and emergency they are found a bed. Like many hospitals, Flinders Hospital in Adelaide used to organise bed allocations in this way, with beds allocated to patients according to an assessment of clinical priority – urgent cases were put in any bed

that became vacant. To manage these bed allocations, the hospital developed a complex central bed management role. Bed managers were responsible for pushing patients into wards, even if the ward did not specialise in that illness or injury. This not only generated conflict and irritation, it also created inefficiencies and safety concerns. For example, clinical teams had to spend increasing amounts of time and effort travelling to and from as many as ten different wards – just to see their patients.

Now Flinders has moved to ward pull, where specialist wards pull appropriate patients towards them as and when beds become free. To cope with situations when the best ward is full, much effort has been put into identifying next best wards for each category of patient.

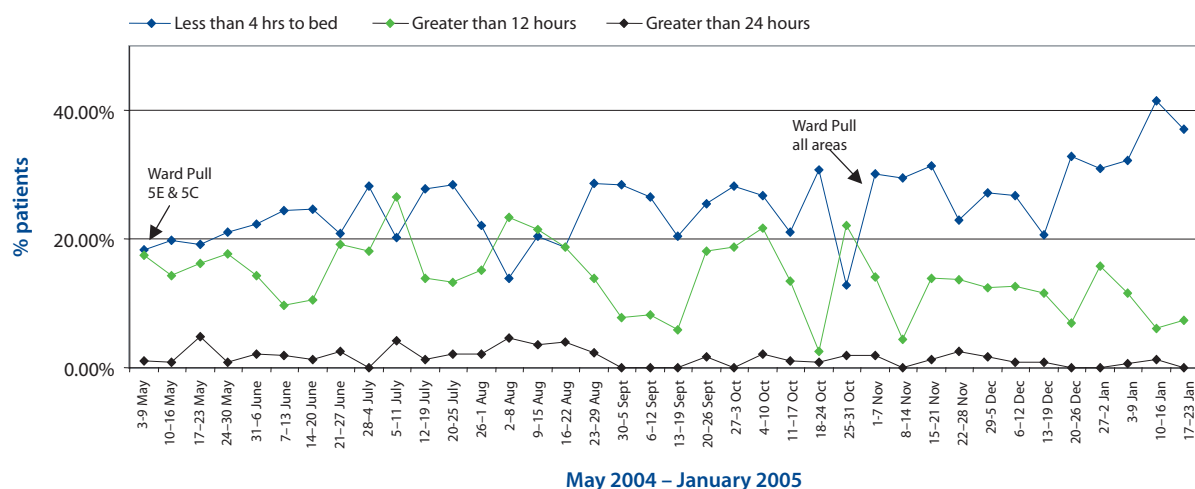
The new system means doctors, nurses and equipment appropriate to the condition are closer to hand more of the time, meaning less travel and fewer occasions when people or equipment are not available. The number of outliers (patients in wards not related to their condition) has halved, patient

turnover has increased 20 per cent, with the median length of stay reduced by one day. At the same time, there has been greatly improved opportunity for team work, better communication between specialists, and the development of a nurse team skill-base appropriate to the condition.

Figure 7: The effect of 'ward pull' on patient waiting times for beds, Flinders Medical Centre, Adelaide. Over the six months after ward pull was introduced, the proportion of patients having to wait longer than 12 hours for a bed fell and the proportion of those waiting for less than four hours rose.

Source: Flinders Medical Centre

Figure 7. The effect of ward pull on patient waiting times for beds



Getting started

So, how can hospitals start the journey towards Lean? Most Lean initiatives involve three basic steps:

- identify value streams
- map value streams
- identify and implement immediate, medium-term and long-term improvements.

Let's touch on each of these in turn.

Value streams

A value stream is all the actions (both value-adding and non-value-adding) and associated information required to bring a product (in our case, a patient) through the value-adding process from beginning to end.

In hospitals it is a natural tendency to group patients by clinical similarity – a lot of useful work has been done on patient pathways, for example, which define the issues and actions we would expect for different patients, at different times, with different

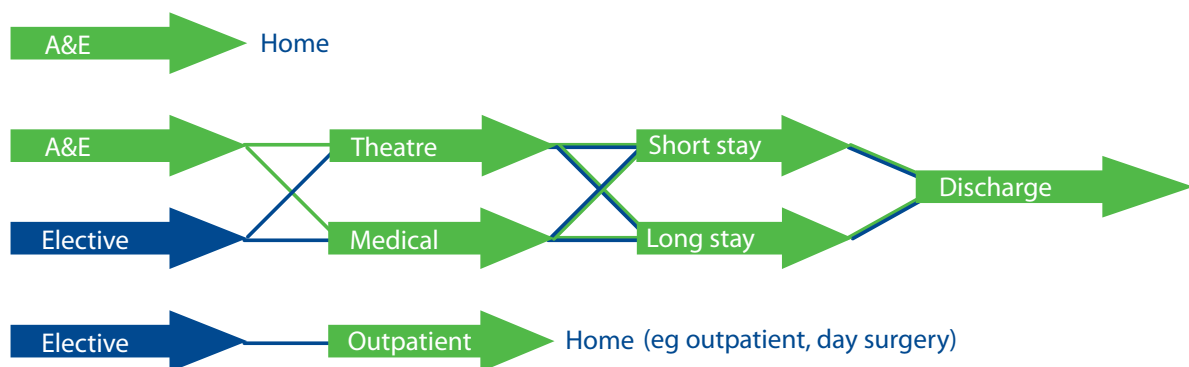
conditions. The difference with Lean is that we focus not on similar clinical conditions but similar processes.

As David Ben-Tovim at Flinders puts it: "In a hospital a value stream is the end-to-end process of caring for a group of patients (a patient-care family) whose overall care processes have enough in common for them to be managed together, irrespective of clinical diagnosis or existing professional boundaries: short things, long things, simple things, complicated things."

Seen in this light, the main value streams of a hospital can be outlined (in extremely simplified form) as shown in Figure 8. The challenge then is to map exactly what happens at each step and stage along the patient journey from admission to discharge,

Figure 8. Value streams group patients together by similarity of process rather than condition. Similar value streams flow at a similar pace and require similar infrastructure, processes, etc. Once a value stream has been identified, it can be worked on, end-to-end, to remove obstacles and improve flow.

Figure 8. Different hospital value streams (simplified)



and to redesign these systems to enable flow – each patient moving on to the next stage seamlessly, without any unnecessary work or waiting. No traffic lights. No disconnects. No ambiguity or confusion.

It is often hard to see value streams. A preliminary high-level map can provide a big-picture overview that allows the value streams to become visible (as illustrated in Figure 3). Ideally, all levels of staff should be involved in drawing this big-picture map. Then they will all see the process end to end – probably for the first time.

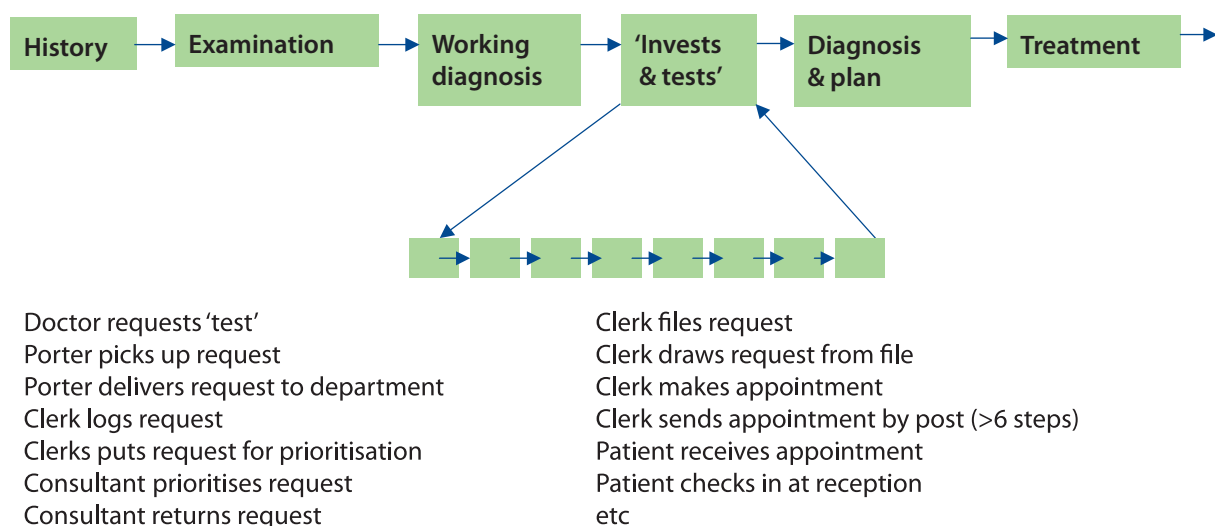
Value stream mapping

The next step is to map every action that is currently taken along a particular value stream – whether necessary or unnecessary – to get the patient moving through the system from one stage to another. Who does what, when, and how long does it take them? What materials or equipment do they need? What information do they use, input or pass on?

Because (almost certainly) nobody has ever done this before, this mapping process is likely to be a huge eye-opener. All sorts of absurdities, possibilities for error and confusion, blockages and bottlenecks are revealed for all to see. Figure 9 shows a small outline example of process mapping. It takes just one stage on the process – in this case, investigations and tests, and lists every step of work that is currently done. Amounts of time, distance travelled, materials needed and so on can be appended to each such step. It quickly becomes obvious that a lot of work is being done without adding much value. The question is how can we redesign these value streams to eliminate or reduce non-value-adding steps and focus resources on improving patient flow and value creation?

Figure 9: Mapping the ‘current state’ of the process invariably highlights all sorts of activities and procedures that are not necessary, do not add value or could be redesigned.

Figure 9. Where is the value?



Rapid improvement events

This mapping process – and the identification of improvement opportunities – is normally done by and with existing staff, so that everybody sees the same picture, and the effects of one person's actions on others become clear for all to see. It is vital that mapping is seen as an exercise in joint discovery and understanding, not as an excuse to point fingers and blame one another for things that go wrong (see 'Involving staff', page 21).

A common next step is to conduct a rapid improvement event. These are usually week-long events which bring together representatives of every skill and process needed to make a department work or a task happen, to pool their knowledge and expertise to create an ideal 'future state' map – what the process could and should look like if it were working perfectly.

Rapid improvement events are action-oriented. Their goal is not to plan, but to do. If there are things that can be done now – today – staff will break out of their formal session to go and do it, there and then. To move machines, create new work areas, design new hand-offs etc. By the end of the week, many people's jobs will have changed significantly. And for ever. It is then up to the team leaders to make sure that the medium- and long-term changes that could not be implemented immediately are followed through.

Continuous improvement

The point of rapid improvement events is not simply to make rapid improvements, however. The real aim is to create a culture of continuous improvement. Some institutions, like Flinders, have formed improvement teams to learn about Lean and pass their learning on by working with other staff members on specific projects.

Continuous improvement is now a catch-phrase that has become widely misunderstood. For example,

continuous improvement is not possible without the creation of clear, standardised processes: without standardisation you have no foundation to improve on. Indeed, without standardisation any improvements you make are unlikely to last.

When Flinders introduced ward pull, for example, the team assumed that, once implemented, the system would work automatically. However, only when clear, standardised processes were put into place – a daily bed management meeting including all wards, an appropriate IT spreadsheet, etc – did the system become embedded in 'the way we work'.

Also, continuous improvement is not some abstract ideal or goal. It is what actually happens when organisations apply Lean principles. Without the cycle of process improvement, standardisation and waste avoidance (which paves the way for further improvement and investment), continuous improvement is just an empty slogan. With this cycle, a ratchet effect is created where each new level of attainment becomes the platform or springboard for even further improvement – to generate accelerating momentum.

Lean and management consultants

Long experience of Lean teaches us that the only things that last are the things people do for themselves.

To get started on a Lean journey, you may need to employ management consultants who have experience of what to do and how. But Lean is not, and should not become, a consultants' gravy train. Any group of well motivated hospital staff members can understand the principles of Lean. So the purpose of bringing in consultants is not to get the consultants' help in solving a particular problem. It is for them to teach staff how to solve their problems by themselves.

Involving staff

To succeed Lean needs to clear a crucial hurdle. An almost inevitable result of Lean initiatives is that fewer people are needed to achieve the same (or more) results. So, potentially, people could lose their jobs. What's more, the changes made in Lean improvement projects can happen unsettlingly quickly: once a Rapid Improvement Event is under way, working practices that have been 'the way we do things around here' for years can be swept away within a week. So feathers will get ruffled.

Yet, for Lean to work, it needs the active, enthusiastic cooperation of staff: it will never happen by order of the management. Indeed, because Lean is about changing the way people work, the most important people in any Lean exercise are not managers, consultants or any other form of expert, but the people who know this work inside out: staff themselves.

So how can this circle of apparent threats to job security and the need for staff involvement be squared? The lesson from long experience is that Lean initiatives rarely succeed unless continuity of staff employment is guaranteed in advance. That is why implementation of Lean has to be separated explicitly from short-term, end-of-year budget balancing crisis measures. Lean may be a way of avoiding crises like these in the future. But it is not a magic wand to wave once the organisation is facing one, (although it was the impetus that set Flinders on its journey.)

A second lesson is that all levels of staff must be involved, from porter to consultant surgeon, from ward assistant to top-ranking administrator. While every individual staff member knows more about his or her particular job than anyone else, most people's in-depth understanding stops there. No matter how clever, expert or professional they are, they do not know or understand the work other people do and will not see how the parts fit together to make the whole. By involving staff at every level, across every function and department, Lean exercises help everybody see how the complete 'value stream' works from end to end, and where the waste is.

"You need to create a shared, joint view of what is going on," says David Ben-Tovim at Flinders. "This is very important because, for example, in hospitals doctors find it hard to listen to anyone else. If they want to, doctors can stop things from happening. And we need them on board."

A third lesson is that people's pride and dignity need to be protected when collecting information about what actually happens – because invariably it will throw up practices which, when seen in the cold light of day, look stupid. That makes the underlying Lean message all the more important: any problems that are uncovered are not the fault of the individual but the system.

Says Ben-Tovim: "We work hard to make sure that everybody's voice is heard, that there is no hierarchy, that there is no culture of blame, and that people go away feeling listened to. It has to be about respect. Our basic assumption is that people want to do a good job and that we have been making it impossible for them to do a good job. We use humour, for example, because it is very important to make people feel OK about having their deficiencies exposed."

The upside is this: once these foundations – jobs not threatened, involvement at all levels, respect for people – are in place, Lean initiatives can unleash waves of enthusiasm. "When we started out, some people were very sceptical," says Bolton chief executive David Fillingham. "But I've never seen anything that energises staff in this way."

Three secrets of successful implementation

- 1 No redundancies as a result of Lean exercises.
- 2 Involve staff from all levels. They are the experts. They will make it happen.
- 3 Show and practice respect for people.

The Lean journey

We started out in this report talking about improvements now being made in one small part of one hospital: the pathology department at Bolton. A 70 per cent reduction in the number of steps needed to complete most tasks; a 40 per cent reduction in the floor space needed; up to 90 per cent reductions in the times taken to do its job – all achieved with less, not more, staff and with limited capital investment (mostly building works to knock a few walls down). Just imagine if similar results were achieved across the whole NHS!

As we saw with the Bolton pathology example this is impossible unless every step of the patient journey is tackled in a similar way. In fact, there are at least three levels of Lean implementation:

- 1** All the points in the patient journeys can be redesigned to make sure they connect, to improve the process as a whole from end to end: admission through diagnosis and treatment to discharge. This requires that every step of patient care, and every support process, goes through the process of value-stream mapping and redesign. Lean practitioners call this 'system kaizen'.
- 2** Lean approaches can be used to reorganise the way a particular task is done or a particular department works, (for example, Bolton pathology department). Lean practitioners call this 'point kaizen'.
- 3** Lean principles can be used to guide strategic decisions such as investment in future capacity and to redesign the way the system itself works. For example, in this report we have only talked about hospitals. We have not talked about primary care. We have not even mentioned fundamental questions such as 'should the patient be treated in a hospital in the first place? Or would it be much better if they were treated in some local facility, or even at home?'

Lean is the way forward for health for four reasons, argues David Fillingham:

- it provides an overall philosophy and a way of setting priorities.
- it has a body of evidence-based tools and techniques.
- there is a vibrant Lean community willing to share experience and expertise.
- it focuses on safety and quality from the patient's perspective but enables these to be delivered at lower cost.

The potential for continuous improvement is therefore genuinely huge: so far, we have barely scratched the surface.

Conclusion

The Lean message is 100 per cent positive. Lean can improve safety and quality, improve staff morale and reduce costs – all at the same time. By freeing human potential it can add value to patient care and improve quality, and create a virtuous circle rather than perpetuating vicious ones.

But Lean won't just happen on its own. It needs leadership and leaders. People willing and able to gather colleagues around them, find out how to do it and win senior management support. It needs managers with the vision to give staff licence to experiment.

Pioneers at places like Flinders, Bolton and Wirral have already learned a lot about implementing Lean, which they are willing to share. Many more in the Lean Healthcare Network have begun their own journeys. But in each case, progress happened because of a few people who were prepared to lead the charge. What about your organisation? Who is leading the charge in your organisation? How about you?

Where to learn more

If you want to learn more, we recommend you get involved with the Lean Healthcare Network in the UK. Find out more at www.leanhealthcare.org.uk.

There is a rich store of materials from a number of sources, including:

Lean Enterprise Academy, UK www.leanuk.org

Lean Enterprise Institute, USA www.lean.org

Lean Enterprise Australia www.lean.org.au

Institute for Healthcare Improvement, USA

www.ihl.org

Osprey Clinical Systems Engineering Programme, UK

www.steyn.org.uk

Bolton Hospitals NHS Trust

www.boltonhospitals.nhs.uk

Wirral Hospitals NHS Trust www.whnt.nhs.uk

Flinders Medical Centre Redesigning

Care Programme

www.flinders.sa.gov.au/redesigningcare

Future Healthcare Network www.fhn.org.uk

Good books on Lean, available through the Lean Enterprise Academy at www.leanuk.org, Amazon and good booksellers, include:

The machine that changed the world, by James Womack and Daniel Jones
The original story of Lean in the auto industry

Lean thinking, by James Womack and Daniel Jones
The Lean principles and action path for manufacturers

Lean solutions, by James Womack and Daniel Jones
Lean for service delivery organisations and healthcare

The Toyota way, by Jeff Liker
Recent description of Toyota's business system

Learning to see, by John Shook and Mike Rother
The action guide to value-stream mapping

Breaking through to flow, by Ian Glenday
The action guide to creating the conditions for flow

The gold mine, by Freddy and Michael Balle
A Lean novel charting a Lean transformation

The Lean Enterprise Academy is a non-profit education and research organisation dedicated to spreading Lean thinking across every sector. It is part of the Lean Global Network of institutes in 13 countries across the globe.

For full details of its activities and the Global Network, go to www.leanuk.org or contact us at: +44 1600 890590 and fax +44 1600 890540
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Lean Enterprise
Academy UK

Lean thinking for the NHS

Although the NHS has made significant progress in the past few years, some have expressed concerns that even greater changes have not been achieved. Certainly the NHS still faces major challenges, and increasing public and political pressure to deliver. However, some of the problems the NHS faces – financial problems, safety concerns and skill shortages, for example, are common to many industries.

The concept of Lean was developed for Toyota and has since been used extensively in manufacturing, project management, and product and service development. In this NHS Confederation Leading edge report the authors

describe how Lean can also be applied to healthcare. They explain how Lean can be used to build on much of the work already undertaken in the NHS to improve the patient's journey. Far from being a management fad, Lean is described here as a tried and tested approach, as applicable to healthcare as commerce. It takes time to embed; while it will not provide a quick fix for all the NHS' ills, it promises to deliver significant improvements over the medium- to long-term.

Lean thinking for the NHS will be required reading for NHS boards and all those working with them to ensure the NHS is effectively run.

The NHS Confederation's *Leading edge* publications are designed to stimulate debate

Lean thinking for the NHS is the second in a series of *Leading edge* reports commissioned by the NHS Confederation, offering leading thinkers the opportunity to propose new solutions to major issues facing the NHS.

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ISBN 1 85947 127 7

BOK 56701

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